

Physician Charting of Coded Emergency Room X-Ray Interpretations Using CARI (Computerized Assistant for Radiology Interpretation)

Laura K. Heermann, RN MS ^{††‡‡}, R. Matthew Sailors, ME ^{†‡‡}, Thomas D. East, Ph.D. ^{†‡‡‡},
C. Jane Wallace, RN MS ^{††‡‡}, Richard L. Bradshaw, BS ^{†‡‡}, Alejandra Lugo, BS ^{‡‡},
Ross Greenlee, MD ^{‡‡‡}

[†] Department of Medical Informatics and ^{††} College of Nursing of the University of Utah and

[‡] Department of Medical Informatics, Cottonwood and Alta View Hospitals,

^{‡‡} Pulmonary Division and ^{‡‡‡} Department of Emergency Medicine, LDS Hospital,
Intermountain Health Care, Inc. Salt Lake City, Utah

In an age of increasing demands for accurate and timely medical charting, it is necessary to reduce the number of steps and amount of time required to get physicians' x-ray interpretations into a form which can be used for automated decision support. This means that the interpretations must be 1) timely, 2) correct, 3) accurate, 4) granular, 5) coded, and 6) electronic.

Other researchers have addressed this problem, but have focused on platform independence and flexible data entry and reporting formats.¹ We chose to focus instead on standardized interfaces with high information density. We chose this strategy due to time constraints of emergency medicine and limited types of findings charted by emergency physicians.

In the LDS Hospital (Salt Lake City, Utah) emergency room (ER), radiographic interpretations are recorded in paper logs which contain the patient's name and/or identification number, image type (chest, abdominal, etc.), emergency physician's interpretation, status of radiologist's review, and radiologist-ER physician interpretation agreement/disagreement, but which omit important pieces of information, including unique image identifiers and follow-up actions. While every attempt is made to ensure that these logs are complete, timely, and interpretable, the hectic environs of the ER and delayed reviews often mean that the logs are not complete enough for real-time decision support.

As part of a larger effort to introduce automated decision support into the emergency room at LDS Hospital in Salt Lake City, Utah, the need arose for coded, electronic x-ray interpretations. As the emergency physicians' interpretations were not available in coded form, and the radiologists' interpretations were not available in real-time, we developed a system to facilitate the charting of coded x-ray interpretations and which is sufficiently responsive not to impinge on the physician's limited time.

To ease the integration of electronic charting of x-ray interpretations into the ER routine, we devel-

oped CARI (Computerized Assistant for Radiology Interpretation) which is designed to simplify the identification of images needing interpretations and the process of charting the interpretations. CARI employs a combination of a GUI (Graphical User Interface) and touch screen technology to facilitate charting of interpretations. Using CARI, physicians can directly enter coded x-ray interpretations into a computerized database which is interfaced into the LDS Hospital's HELP system's electronic patient records. The system will also be tied into LDS Hospital's digital radiology system when it is fully integrated into the emergency room.

CARI's primary interface displays a list of images needing interpretation. From this screen, new images may be added to the system database, physicians may interpret images, and different views of the image database (all images for a given patient, etc.) may be accessed.

Physician interpretations are charted using checkboxes to indicate location-specific findings. The specific findings were selected from the existing x-ray logs and represent the most commonly charted findings in each of the image types (locations). Where appropriate, generic findings (e.g. fractured rib) may be made more specific (e.g. fractures of ribs 1 and 2 on right side and 3 and 4 on left side) through hierarchical menus and screens. The charting of more specific information is always at the physician's discretion.

Initial physician reaction to the system has been positive. CARI will be undergoing further testing and refining during the next several months.

References

1. Kahn CE, Wang K, Bell DS. Structured entry of radiology reports using World Wide Web technology. *Radiographics* 1996;16(3):683-91.

Contact information: Laura K. Heermann, RN, Pulmonary Division, LDS Hospital, 8th Ave. & C St., Salt Lake City, UT 84143. ldlheerm@ihc.com.